

REMARKS

The independent claims have been further amended to explicitly recite that the adhesive tape supports both the die and the lead frame during a wire bonding operation. As explained in more detail below, it is respectfully submitted that none of the art of record taken alone or in any reasonable combination discloses or reasonably suggests the inventions set forth in the pending claims.

The rejections based on Djennas

The pending claims have been rejected on the combination of Djennas, Ogawa and Pace. It is respectfully submitted that the pending claims are patentably distinct from the combinations asserted in the outstanding rejection. The outstanding rejection relies primarily on the combination of three very different embodiments that are described in the Djennas reference. For at least the reasons set forth below, it is respectfully submitted that the proposed combination of the three different embodiments of Djennas would not have been obvious to those of ordinary skill in the art at the time of the present invention.

The Djennas reference is generally directed at a variety of different arrangements for manufacturing wire bonded semiconductor devices having no die supporting surface. Most of the described embodiments (i.e., the 1st through 5th embodiments – figures 4-17) contemplate the use of a vacuum to hold the die in place during the wire bonding operation. In such embodiments a variety of different mechanisms are used to hold the die in place during the encapsulation operation. Djennas teaches that these vacuum based die holding embodiments may be used with both lead frame based packages (embodiments 1 & 2 – figures 4-10) and substrate based packages (embodiments 3-5 – figures 11-17). In the last three described embodiments, an adhesive tape is used to support the die and a substrate during both the wire bonding and encapsulation processes (embodiments 6-8 – figures 18-26). However, despite the fact that Djennas expressly considers both lead frame and substrate based packages and details a number of different potential embodiments, **Djennas never teaches or remotely suggests that the adhesive tape is suitable for use in assembling lead frame based packages.**

The outstanding rejection effectively argues that since Djennas includes some boilerplate type language pointing out that the “placement and geometry of the leads on the lead frame and of the conductive trances on the substrate are not restricted by the present invention,” and that “other external lead configurations are possible,” that somehow it would be obvious to those of ordinary skill in the art to utilize an adhesive tape in lead frame package assembly to support both the die and the lead frame during the wire bonding and encapsulation processes in the manner recited in the claims of the present application. This boilerplate language does nothing to suggest the specific combinations set for in the pending claims. Accordingly, such a conclusion is respectfully traversed.

Initially, it is apparent that the inventors of the '958 patent themselves did not recognize the advantages of using an adhesive tape to support both a die and a lead frame during wire bonding and encapsulation processes. In the '958 patent they described a number of complicated vacuum based arrangements for supporting a die during wire bonding in great detail, yet they failed to recognize the benefits of using an adhesive tape to secure both a lead frame and the die during both wire bonding and molding as required by the present application. If they had recognized the significant cost advantages of such an approach, they surely would have described the arrangement in the '958 patent. Thus, the outstanding rejection effectively suggests that despite the fact that the inventors of the '958 patent did not recognize the benefits of the arrangement claimed in the present invention, that upon reading the reference, others skilled in the art somehow would have recognized such benefits. It is respectfully submitted that such a conclusion can only be reached using impermissible hindsight after reviewing the present application.

The '695 patent's inventors failure to appreciate the advantages of the present invention is not surprising because conventional wisdom would hold that although a molding material has sufficient strength to hold an overmolded substrate after encapsulation due to the large surface area of the substrate, lead frame based packages are very different. Specifically, a significant concern was that since the leads of a lead frame have a much smaller surface area than a substrate, that overmolding a lead frame (i.e., leaving the bottom surfaces of the lead frame exposed at the bottom surface of a package) would be undesirable due to a concern that they leads may be subject to delamination. Additionally, conventional wisdom would suggest that if the lead frame is intended to be exposed at the bottom surface of a package, then molding flash formed on the bottom surface of the leads would cause reliability problems. This concern is evidenced by the Melton reference that has been applied separately, which went to great lengths to provide electrical contacts other than the exposed lead frame.

The independent claims have been further amended to explicitly recite that the adhesive tape supports both the die and the lead frame during a wire bonding operation, which is neither disclosed nor reasonably suggested by Djennas.

It is believed that the significant differences between packaging substrate based packages and lead frame based packages would make it highly unlikely that a person of ordinary skill in the art at the time of the present invention would have been motivated to combine the first, third and sixth embodiments of the Djennas reference to produce a package in accordance with the claimed inventions. Indeed, it is respectfully submitted that the fact that Djennas suggests using the tape without remotely suggesting that the tape can be used in lead frame based packaging is strong evidence of the fact that a person of ordinary skill in the art at the time of the present invention would NOT have been motivated to make the combination proposed in the outstanding rejection.

As mentioned above, the outstanding rejection relies primarily on the combination of three different embodiments disclosed by Djennas. Specifically, the first embodiment (Figs. 4-6) illustrates a lead frame based package with a floating die. The third embodiment (Figs. 9-10) illustrates a lead frame based package with an exposed die, although the leads are not co-planar with the bottom surface of the die. The sixth embodiment (Figs. 18-22) illustrates a substrate based package that uses an adhesive tape to support the die during wire bonding and encapsulation.

The primary embodiment relied on in the outstanding rejections based on Djennas is the first embodiment. As acknowledged by the Examiner, this embodiment does not contemplate the use of an adhesive tape to support the die during wire bonding or encapsulation. This is not surprising since the embodiment illustrated in Figs. 4-6 contemplates the use of a floating die that is NOT exposed on the bottom surface of the package as required by both independent claims 1 and 7 of the present application. Additionally Figures 4-6 of Djennas contemplate a traditional lead frame based package arrangement where the leads protrude from the sides of the package rather than being exposed on the bottom surface of the package as specifically required by both independent claims 1 and 7 of the present application. Since neither the die nor the bottom surfaces of the leads are intended to be exposed in the first embodiment of Djennas, it would make no sense whatsoever to use a tape to support those structures during encapsulation.

The outstanding rejection then uses the third embodiment of Djennas (Figs. 9-10) to suggest that the lead frame based package illustrated in the first embodiment may be modified to an arrangement in which the die is exposed. However, like the first embodiment, the bottom surfaces of the leads are not intended to be exposed in this embodiment and indeed the bottom surface of the die is not contemplated to be co-planar with the bottom surface of the leads, so again, it would make no sense whatsoever to utilize an adhesive tape to support the die and lead frame in such an embodiment.

Since neither the first or third embodiment utilize a tape to carry the lead frame or die (and since the use of such tape would make no sense in the context of those package designs), the outstanding rejection relies on the tape used in the sixth embodiment of Djennas. However, Figure 20 illustrates a substrate based package that does NOT incorporate a lead frame. As will be appreciated by those familiar with the art, unlike most traditional lead frame based packages, substrates used in a substrate based package are traditionally exposed on the bottom surface of the package. In the embodiment illustrated in Fig. 20, the substrate 100 (i.e., a PCB) is a solid piece with a hole cut out in the region of the die. Since the substrate is solid, encapsulant does NOT extend between adjacent contacts and does not fill gaps between adjacent contacts as required by independent claims 1 and 7. Rather the walls of the hole in the PCB form the peripheral boundaries for the encapsulant that contacts the tape. Thus, the encapsulant will only contact the tape in the central region of the package around the die. In contrast, in the claimed lead frame based arrangement, the encapsulant extends between adjacent leads such that it

contacts the tape between adjacent leads. It is respectfully that this is a significant difference that would prevent a person of ordinary skill in the art at the time of the present invention from applying the tape used as a carrier in a substrate based package to use a tape in the claimed manner in a lead frame based package.

It is well established that to support an obviousness rejection, the prior art must suggest the desirability of the claimed invention. See, e.g., MPEP 2143.01. As discussed in detail above, it is respectfully submitted that there is no suggestion whatsoever in the Djennas reference (or in the other art of record) that would motivate a person of ordinary skill in the art to make the combination of the three different embodiments of Djennas proposed in the outstanding rejection. Accordingly, it is respectfully submitted that a prima facie case of obviousness had not been made and that the rejections of claims 1 and 7 should be withdrawn for at least this reason.

The secondary Ogawa and Pace references that are utilized in the outstanding rejections were cited for other reasons and do not make up for the deficiencies in the base combination applied in the outstanding rejections. Accordingly, it is respectfully submitted that claims 1 and 7 are patentable over the art of record for at least the reasons set forth above and that the outstanding rejections of those claims should be withdrawn.

Claims 2 – 6 each depend either directly or indirectly from independent claim 1 and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to claim 1. Additionally, some of these dependent claims require additional elements that when considered in the context of the claimed arrangements further patentably distinguish the art of record.

Claims 8 – 10 each depend either directly or indirectly from independent claim 7 and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to claim 1 and 7 discussed above. Additionally, these dependent claims require additional elements that when considered in the context of the claimed arrangements further patentably distinguish the art of record.

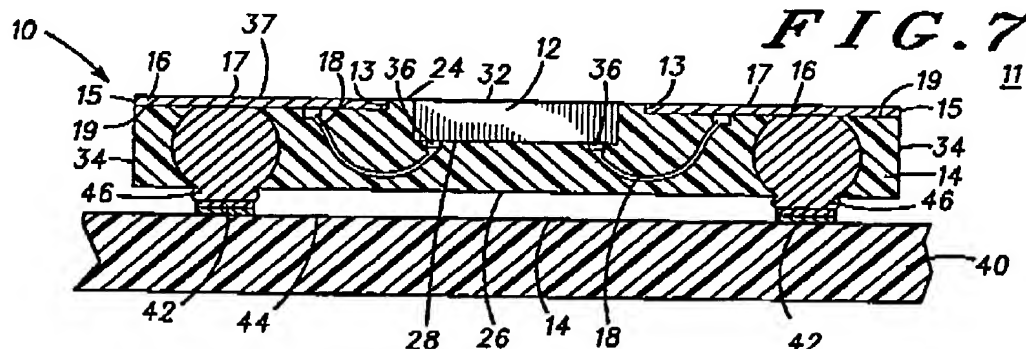
The rejection based on Melton

The claims were also rejected on the basis of Melton in combination with Ogawa and the applicant's admitted prior art. These rejections are respectfully traversed.

As presently presented, independent Claims 1 and 7 each require that the leads form the external contacts (indeed the only external contacts) for the resulting integrated circuit package. This is quite different than the structure contemplated by Melton. Specifically, Melton

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contemplates the formation of internal metallic (solder) bumps 20, which are exposed on the surface of the package opposite the lead frame 22. As can be readily seen in Fig. 7 of Melton (reproduced below), it is these metallic bumps that provide the electrical contacts to external devices. Melton does not appear to contemplate using exposed portions of the lead frames as his external electrical contacts.



It should be appreciated that the package structure recited in claim 1 of the present application is substantially easier to produce than the package describe by Melton. The outstanding rejection appears to acknowledge this deficiency in the Melton reference and instead asserts that it would be obvious to one of ordinary skill in the art to replace the lead frame of provide the method of Melton with the lead frame of Ogawa. However, replacing the lead frame of Melton with the lead frame of Ogawa would do nothing to cure the deficiency of Melton. That is, if a person of ordinary skill in the art were to utilize the lead frame of Ogawa in a package as taught by Melton, they would simply swap the lead frame disclosed by Ogawa for the lead frame 22 of Melton. If this were to occur, the resulting structure would remain substantially the same as illustrated in Figure 7 of Melton. Thus, the replacement of the lead frame of Melton with the lead frame of Ogawa would not in any way change the fact that Melton (and thus the combination) contemplates the use of internal metallic bumps 20 (which are attached to the unexposed surface of the lead frame 22 and extend internally through the package) to form the external electrical connections.

The outstanding rejection appears to be premised on the erroneous assumption that if one were to replace the lead frame of Melton with the lead frame of Ogawa, that somehow that would also result in the elimination of the metallic bumps 20. As is apparent from reading the Melton reference, the entire purpose of the method disclosed by Melton was to secure internal metallic bumps 20 to a lead frame 22 (as shown in Fig. 4) and to utilize those metal bumps (rather than the lead frame) as the external contacts. Ogawa simply discloses an alternative lead frame construction. Therefore, if one were to combine Ogawa with Melton, they would simply put the metallic bumps 20 on the lead frame of Ogawa, which would result in a structure rather

similar to Figure 4 of the Melton reference. The rest of the Melton process would remain unchanged. Indeed it would entirely defeat the purpose of Melton to eliminate the internal metallic bumps 20. It is well recognized that a combination proposed to support an obviousness type rejection may not "change the principle of operation of a reference." See, e.g., MPEP § 2143.01 (section entitled - THE PROPOSED MODIFICATION CANNOT CHANGE THE PRINCIPLE OF OPERATION OF A REFERENCE). It is respectfully submitted that eliminating the metallic bumps 20 on the Melton reference would clearly change Melton's principle of operation and therefore the outstanding rejection based on the Melton reference should be withdrawn for at least this reason. Additionally, it is respectfully submitted that the outstanding rejection does not provide any motivation whatsoever for combining the Ogawa reference with the Melton reference in a way that would eliminate the metallic bumps 20, which serve as the external electrical contacts. Ogawa does not offer such a motivation, Melton does not offer such a motivation, and the outstanding office action does not point to or offer such a motivation. Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been made in the present case and that the outstanding rejections based on a combination including the Melton reference should be withdrawn for at least these reason.

Claims 2 - 6 each depend either directly or indirectly from independent claim 1 and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to claim 1. Additionally, some of these dependent claims require additional elements that when considered in the context of the claimed arrangements further patentably distinguish the art of record.

Claims 8 - 10 each depend either directly or indirectly from independent claim 7 and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to claim 1 and 7 discussed above. Additionally, these dependent claims require additional elements that when considered in the context of the claimed arrangements further patentably distinguish the art of record. These dependent claims highlight the differences in the intended usage of the present invention and the package design taught by Melton.

Objection to the Reissue Declaration

The outstanding office action also states that the reissue declaration is defective. The Applicant would be happy to provide a supplemental reissue declaration one the allowability of the claims has been agreed to if the Examiner feels that the reissue declaration is somehow still defective at that time. Non-withstanding that offer, it is noted that **new independent claim 7** does NOT include the requirement of leads that extend "radially from a central opening." When a patent is alleged to be defective due to being unnecessarily narrow in some respect in a reissue declaration, there is no requirement that any of the original claims be changed. Rather, new

claims (such as new independent claim 7) may be added to correct such an alleged defect. Accordingly, it is respectfully submitted that the current reissue declaration fully complies with the rules.

Conclusion

In view of the foregoing, it is respectfully submitted that all pending claims are patentable over the art of record and that this case is in condition for allowance. Should the Examiner have any remaining concerns regarding the present application, he is encouraged to contact the undersigned at the telephone number set out below.

Respectfully submitted,
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